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14. ABSTRACT

This work unit is the first of a three-year coupled rapid transition plan 6.2-6.4 development effort to transition products from the NRL Aerosol Analysis and Prediction System (NAAPS) to a database where they can be extracted by Target Acquisition Weapons Software (TAWS). This will enable NAAPS data to be directly accessible to the warfighter for mission planning purposes, and will provide information in areas where no visibility information is available. This will also allow TAWS to become a forecasting tool. Goals include developing methods to produce aerosol parameters, and incorporating these parameters into the tactical environmental data server (TEDS). We next need to develop a general interface to extract slant path parameters from TEDS and to convert current radiative post-processor codes (extinction, optical depth, visibility) to use the TEDS database for input. TAWS must be modified to utilize these new parameters in TEDS, and we must conduct ???multiple level??? TAWS experiments and verification with the new input (multi-level extinction coefficients, and scattering phase function description). Finally we need to document the experimental TAWS performance vs. the existing TAWS, and validate against observations to quantify the improvement.

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Slant-Range Detection in the Visible Wavelength

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LONG-TERM GOALS

This work unit is the first of a three-year coupled rapid transition plan 6.2-6.4 development effort to transition products from the NRL Aerosol Analysis and Prediction System (NAAPS) to a database where they can be extracted by Target Acquisition Weapons Software (TAWS). This will enable NAAPS data to be directly accessible to the warfighter for mission planning purposes, and will provide information in areas where no visibility information is available. This will also allow TAWS to become a forecasting tool. Goals include developing methods to produce aerosol parameters, and incorporating these parameters into the tactical environmental data server (TEDS). We next need to develop a general interface to extract slant path parameters from TEDS and to convert current radiative post-processor codes (extinction, optical depth, visibility) to use the TEDS database for input. TAWS must be modified to utilize these new parameters in TEDS, and we must conduct "multiple level" TAWS experiments and verification with the new input (multi-level extinction coefficients, and scattering phase function description). Finally we need to document the experimental TAWS performance vs. the existing TAWS, and validate against observations to quantify the improvement.

OBJECTIVES

The objective is to incorporate the higher spatially and temporally resolved aerosol/optical parameters from the Navy Aerosol Analysis and Prediction System (NAAPS) into TEDS for use by the Target Acquisition Weather Software (TAWS) in the computation of slant range visibility. This capability is intended to meet one of the longest-standing Fleet METOC requirements for the purpose of improving sensor performance prediction in support of Strike, Air-defense, and Infrared Search and Track (IRST).

APPROACH

To improve the aerosol analysis, existing aerosol optical depth retrieval algorithms from NAAPS will be used. To improve TAWS performance, the approach will be to integrate the existing (and soon to be available) observations with the model output to improve the spatial description of EO impact variables (e.g. aerosol, moisture, clouds). The problem of slant path detection in the visible wavelengths will be addressed by incorporating aerosol/optical parameters from NAAPS into TEDS for use by TAWS. NAAPS is a tropospheric aerosol model used to generate near real-time, global forecasts. It uses meteorological fields from NOGAPS to generate dust, sulfate, and smoke forecasts at 6-hour intervals out to 120 hours on a 1x1 degree horizontal grid with 18 vertical layers. The new capability of NAAPS to forecast aerosol information as a function of location, altitude and wavelength

will be included, along with NOGAPS and COAMPS products, into TEDS. Hence, our approach is "top to bottom" in that we begin with deriving new model parameters, developing methods from their inclusion into an operational database, compose retrieval algorithms and incorporation into TAWS, and develop new radiative transfer code in TAWS to take advantage of these new parameters.

WORK COMPLETED

Source code for TAWS, MODTRAN, and other radiative transfer schemes were acquired. Staff are currently learning the TAWS and NAAPS systems, and have begun to make alterations to the code.

File and data transfer methodologies were investigated. Work has begun to standardize NAAPS input and output files into Network Common Data Form (netCDF) format. NetCDF has advantages over other file formats for our purposes in that it is self-describing, supports multiple dimension arrays, and can be integrated into METCAST, the Navy's meteorology distribution portal. This job is near completion.

We have begun to examine the source code of TAWS and are currently working to incorporate MODTRAN into the atmospheric transmission model (currently Beer's law is used).

RESULTS

In this first year of work, the TAWS atmospheric transmission module has been scrutinized. Legacy code has been tracked back to its original sources, and some inconsistencies detected. Before a new transmission module is implemented, the other target/background and sensor modules need to be examined further to determine if unforeseen impacts may result from the upgrade in aerosol inputs. To this end, sensitivity tests are currently underway. Code is currently being written to run the TAWS transmission module and the complete TAWS model in real time, based on NAAPS and NOGAPS fields.

TRANSITIONS

The TAWS improvements/modifications will be incorporated into the current baseline code by Northrop Grumman under contract to USAF ESC using previously established transition procedures. Operation of the new code will be evaluated and approved by the TAWS Change Control Board, at which time the program will be released for use by USA, USAF, USN, USMC, and USCG. USN distribution is through NITES II, GFMPL and approved CD distribution to OA divisions, METOC Detachments and USMC MAWTS-1 and MEW units.

RELATED PROJECTS

The NRL 6.1 base *Atmospheric Physics*, NRL 6.2 base *Improved COAMPS Land Boundary Layers* (includes COAMPS aerosol modeling) and NRL 6.2 *Advanced Moist Physics Modeling* use NAAPS data and products and the satellite retrievals for investigations and validation. The ONR 6.2 *Atmospheric Aerosol Characterization* will also use NAAPS simulations for high-energy laser research. This project utilizes the products of the ONR 6.2 project *Aerosol Microphysics and Radiation*.